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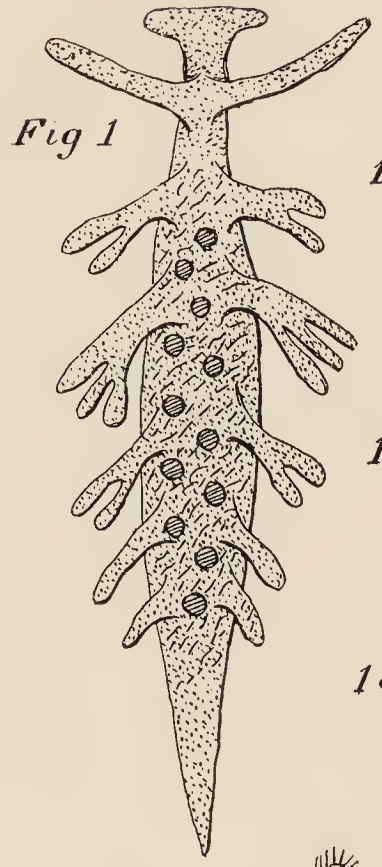
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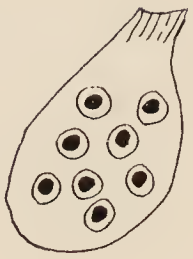
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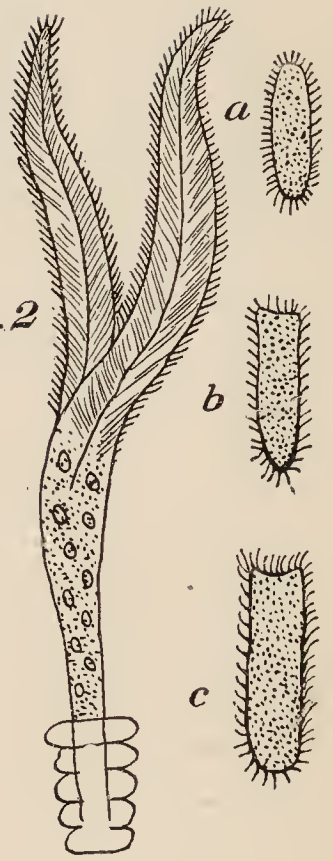
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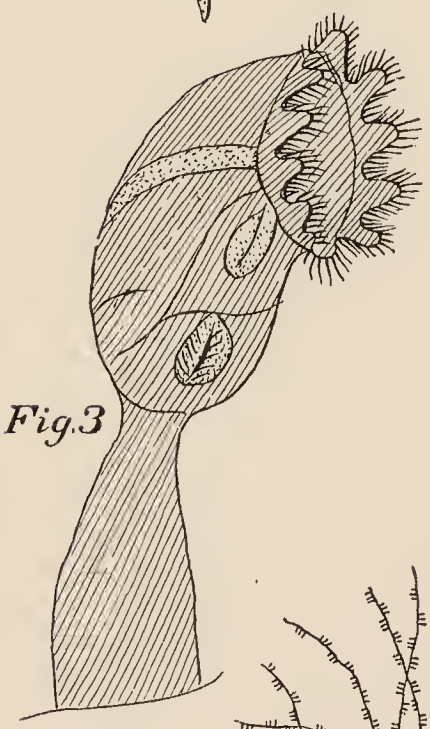
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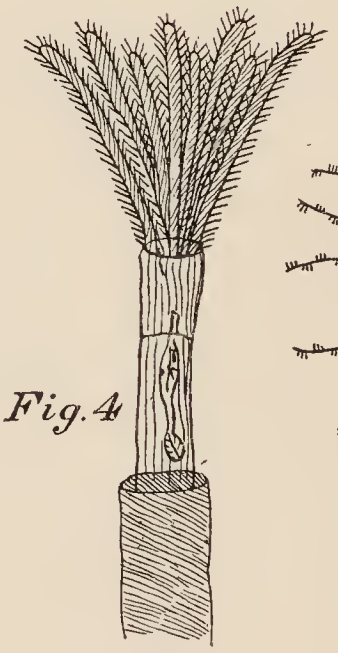
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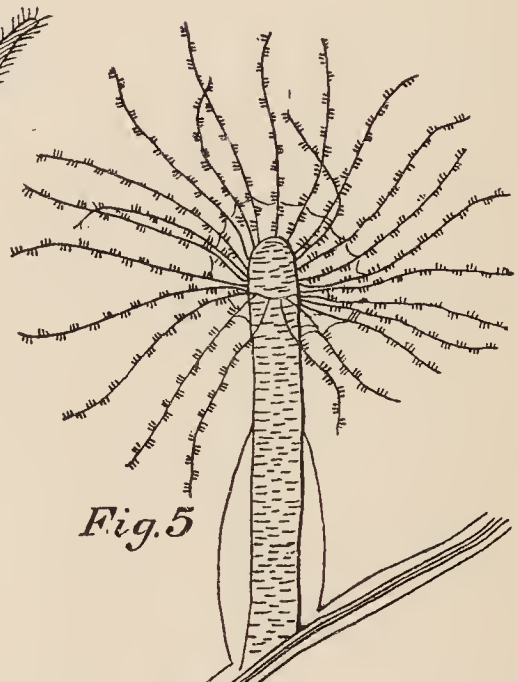
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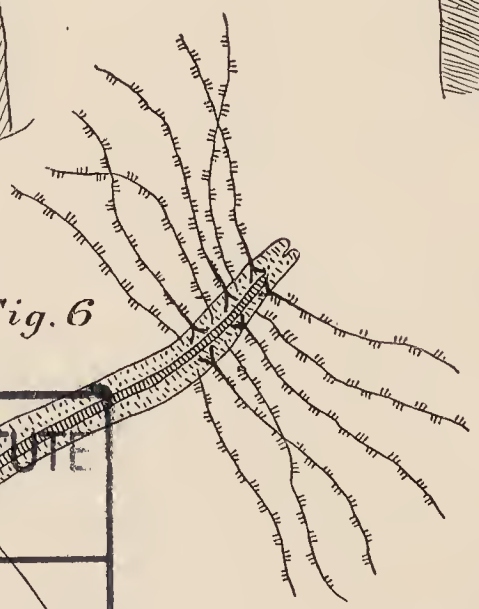
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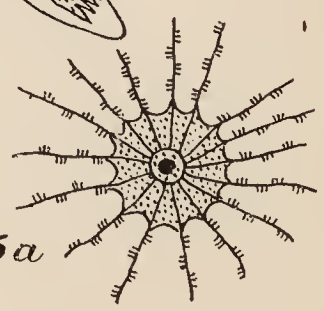
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HELM ON AQUATIC LIFE.

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VOL. VIII. APRIL, 1892. No. 2.

CORDYLOPHORA LACUSTRIS, AND FIVE NEW FORMS OF ANIMAL LIFE.

BY STEPHEN HELM.

(*Read December 4th*, 1891.)

In the latter part of September last I explored the portion of the Morris & Essex Canal lying between Pamrapo and Newark Bay, N. J. On first inspection the result was disappointing, but a more careful examination revealed isolated specimens of two forms (Pl. 29, Figs. 3 and 4) which were new to me. Thinking it probable that another part of the same canal might perhaps yield better results, I, on another occasion, proceeded to that section lying between Greenville and Claremont.

Here, to my intense satisfaction, I found the same two forms in considerable abundance, and, to my delight, three others which were also new to me (Pl. 29, Figs. 1, 2, 5). The question then arose, What are they? After carefully searching through all the literature on the subject at my command, after communication

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Explanation of Plate 29.

FIG. 1. The molluscan designated as No. 1. 1*a*. Egg-cluster as first observed. 1*b*. Egg, with mulberry-shaped contents. 1*c*. The same advanced to a rotifer-like form. 1*d*. The free swimming "rotifer." 1*e*. The same at time of attachment. 1*f*. The same with budding processes.—FIG. 2. *Lagotia cæruleus* Helm. 2 *a*, *b*, *c*. Stages of development (after Wright).—FIG. 3. *Urnatella Walkerii* Helm.—FIG. 4. *Octocella libertas* Helm.—FIG. 5. *Cordylophora coronata* Helm. 5*a*. The same: view of tentacles, web, and oral aperture from above.—FIG. 6. *Cordylophora lacustris* Allman.

with many microscopists of large experience, and after considerable correspondence, I fail to find any record of these specific forms. I am, therefore, driven to the conclusion that they are new to this country, and probably new to science, and the pleasurable duty of introducing them devolves on me.

Should the publication of this paper, however, lead to their identification, I shall be glad to receive any communication on the subject, and shall even then have the satisfaction of rescuing from partial oblivion forms which ought not to remain in obscurity.

One of the gentlemen whose counsel I sought was Dr. A. C. Stokes, of Trenton, N. J., editor of *The Microscope*, and a corresponding member of this Society. He very courteously replied that all except No. 5 were new to him, and that he thought, from my drawing, was *Cordylophora lacustris;* and if not, then it was an allied species.

I have since had considerable correspondence with him, and, although personally a stranger, he has evinced intense interest in my finds; and whilst he is a very busy man, I hope to have the advantage of his critical experience in the preparation of the more technical descriptions of these forms, which I propose to prepare during the remaining winter months.

As to the names which I have attached to four of the five forms, I wish explicitly to state that they are provisional only, and are given pending the settlement of the question whether they are new or only rare species.

The remaining form, though unquestionably a molluscan, differs so widely from hitherto described forms that it seems to demand a niche for itself. I therefore await results, and shall, whilst endeavoring to complete my observations, in the meantime designate it as No. 1.

On my first introduction to it, all I saw were two processes, standing out from confervoid and other growth, on the stem of a plant I was examining for other objects. A current was being produced as powerful as that of *Melicerta* and other large Rotifera, and presently more processes, and finally an entire animal crept into the field of view—an animal so unlike anything I had seen before, or even remembered to have read of, that I was at first amazed and then intensely interested. For its size

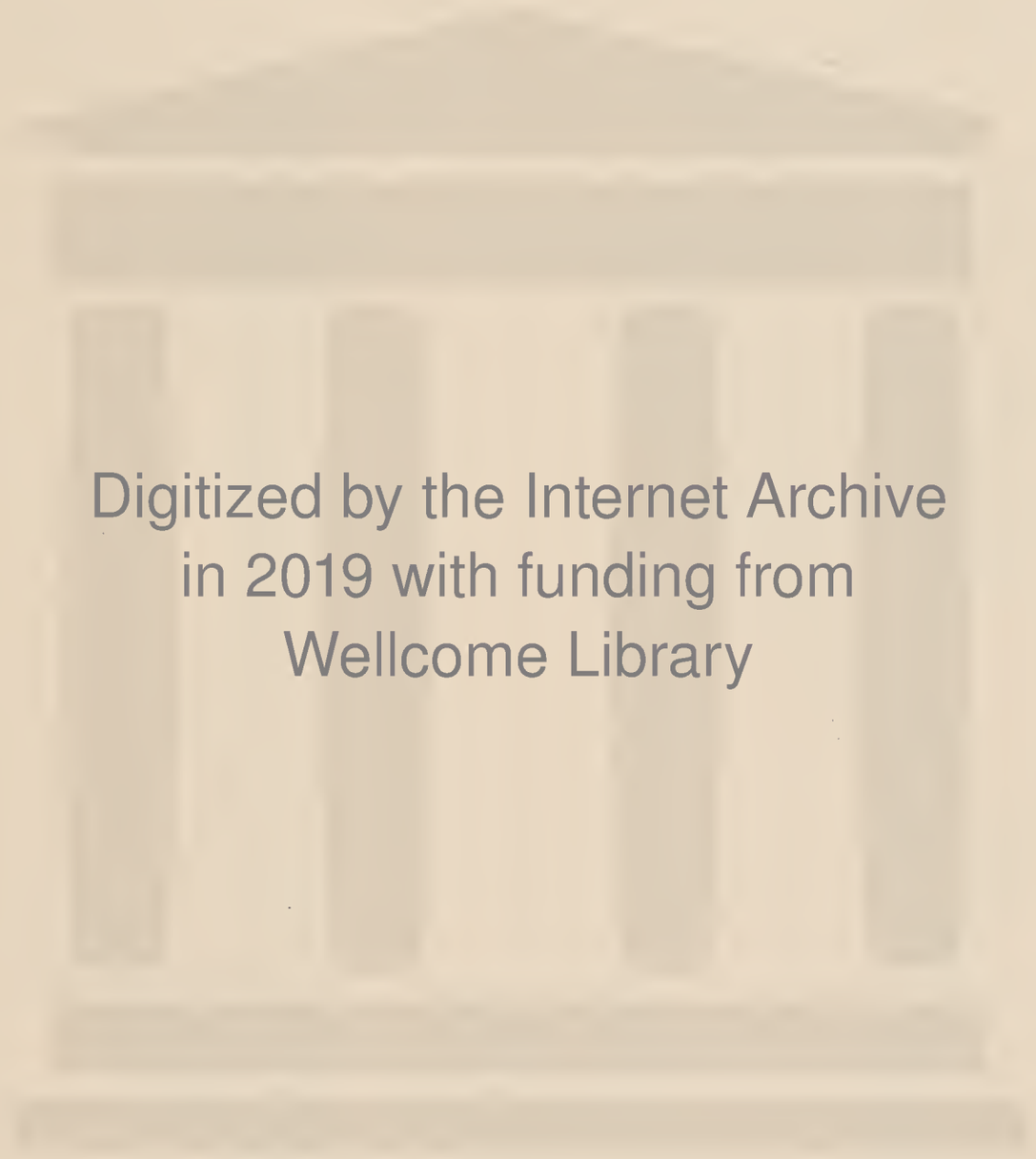

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Fig. 2.

Fig. 3

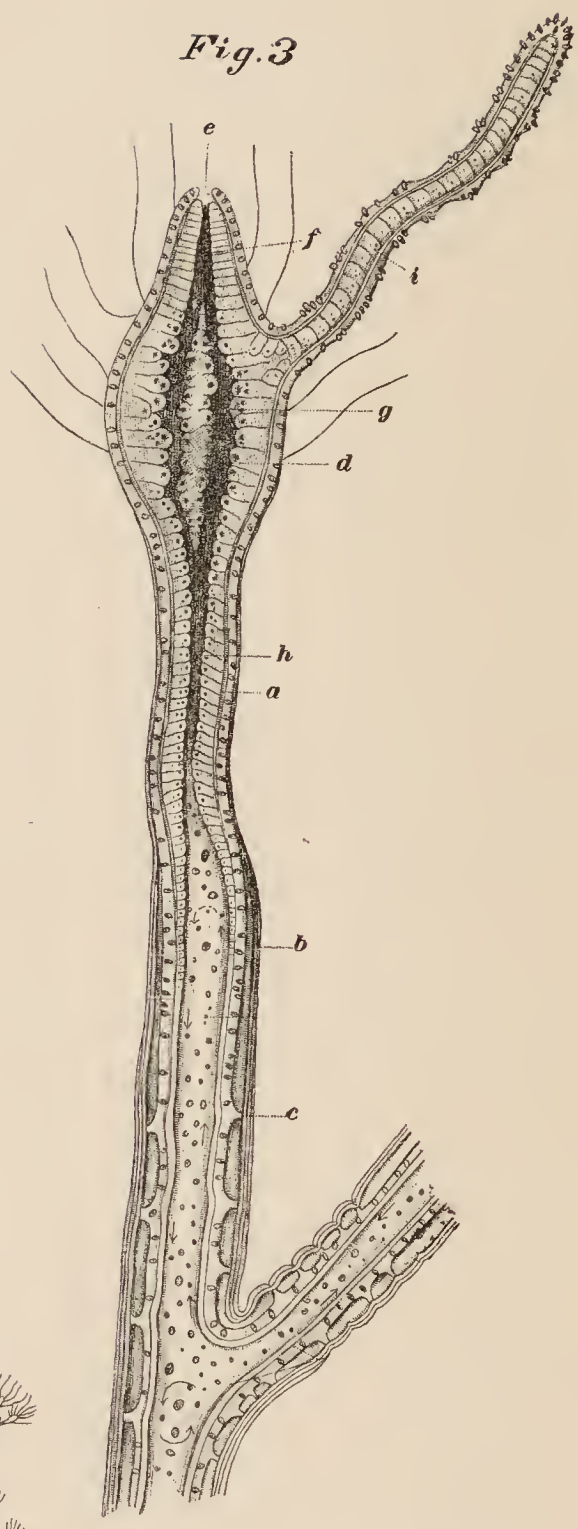
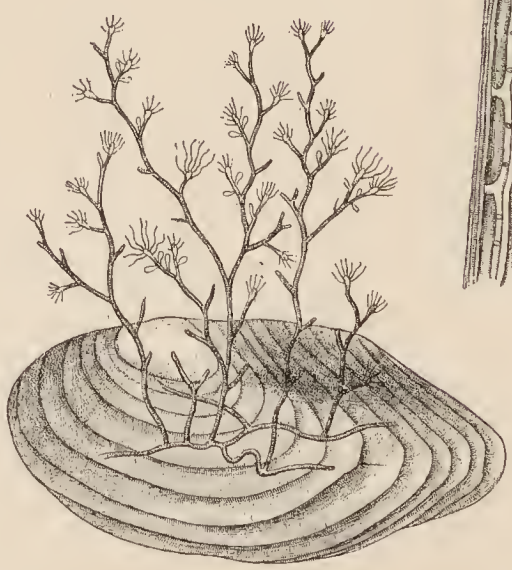


Fig. 1



CORDYLOPHORA LACUSTRIS.

—one-fourth of an inch in length—and means of locomotion, it moves pretty rapidly and without any apparent effort, its motion being the easy, firm, sliding movement so familiar in the slug and snail.

The processes seem to develop with the growth of the animal, the maximum number I have seen being seven pairs. The two anterior processes are more pointed than any of the others, and are generally directed forward. Of the remainder, the second pair is forked for about one-half of the long diameter; the third pair divided into three; the fourth into two again; whilst the remainder are single, the posterior pair being considerably smaller than the others. They are all slightly inclined backward as the animal moves along. The body terminates in a pointed tail equal to about one-third of its length.

The current is produced by innumerable "papillæ," which move with a sort of undulatory motion and apparently cover every portion of the body. The first impression produced is that of cilia, and in certain lights it is difficult to persuade one's self they are not, as when seen edgewise they are very thin. They are often quiescent, and what purpose their motion serves I cannot imagine, as the animal seems to feed slug-fashion; and though I have not yet made out its mouth, its possession of a lingual membrane presupposes the existence of one.

I have not absolutely satisfied myself as to the method of reproduction, but after many observations have arrived at certain conclusions. The body is composed of sarcode, and in the tail a rapid circulation may be seen; but the central portion of the body is so opaque that very little can be made out without dissection, and until my stock increases I am loath to sacrifice many in that way. Underneath the frog-like pigment cells of the back I have observed many round cells, and, suspecting them to be immature egg-clusters, I isolated two specimens and found my suspicions

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Explanation of Plate 30. (After Allman.)

FIG. 1. *Cordylophora lacustris* Allman, attached to a dead valve of *Anodon cygneus*. Reduced two-thirds natural size.—FIG. 2. A branch, magnified, with the polyps in various states of expansion, and with the reproductive capsules more or less developed. —FIG. 3. Longitudinal section of polyp, to show the details of its structure. *a*. Ectoderm. *b*. Polypary. *c*. Processes from the ectoderm attached to inner surface of the polypary. *d*. Endoderm. *e*. Mouth. *f*. Post-buccal cavity. *g*. Stomach. *h*. Common canal of the cœnosarc. *i*. Muscles.

confirmed by the deposition within three or four days of several clusters, containing from four to eighteen eggs each (Fig. 1*a*). These I carefully watched, and after some days observed :

1. The dense contents gradually assumed a mulberry shape (Fig. 1*b*), and then there set in a rapid revolution of the cell contents.

2. A development of a rotifer-like form (Fig. 1*c*) with two strongly ciliated heads, always in motion, but still within the egg.

3. The rotifer-like form escaped (Fig. 1*d*) and became a free swimmer. It now had a kind of tail in process of development.

4. The ciliated heads disappeared, and attached by the tail it assumed the form shown in Fig. 1*e*.

Unfortunately, I am not able to devote continuous observation to my specimens, hence my uncertainty ; but I have further seen what I believe to be developed from Fig. 1*e*—a form (Fig. 1*f*) with one pair of processes, and another with three pairs, my first specimen having six pairs.

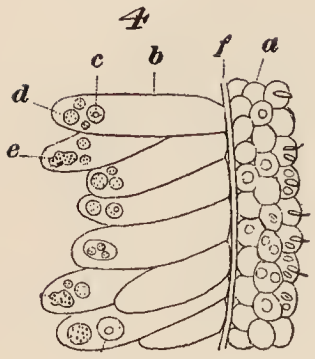
Lagotia Cæruleus sp. n. (Pl. 29, Fig. 2).

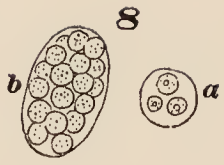
Figure 2 must undoubtedly be referred to the genus *Lagotia* Wright described in " Pritchard's Infusoria," and figured on Plate 31, Figs. 7–13. His description of *L. producta* is as follows :

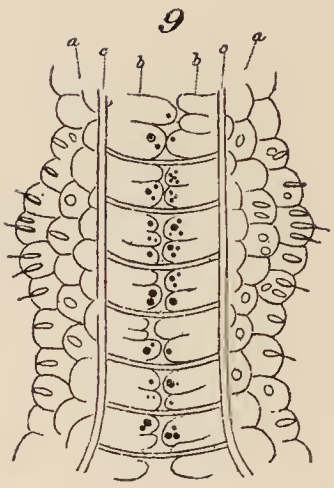
" Neck of sheath exceedingly prolonged, annulated sheath of a pale yellow-brown color. Animalcule (= zoöid) two or three times the length of the sheath, attenuated ; ciliated lobes erect, divergent, and re-curved at tips ; color of zoöid, deep blackish-green.

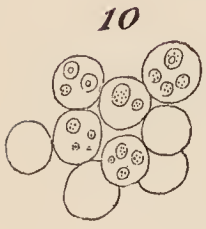
" Dr. Wright observed the development in this species of ciliated embryos, which, after passing through the stages seen in Figs. 2 *a*, *b*, *c*, and carrying on an active existence as free ciliated animals, form an attachment to some surface, and proceed to develop a sheath and the characteristic ciliary lobes. The transformation from ciliated embryos to *Lagotia producta* transpired in the course of a night, the sheath even during that time being completed with its rings."

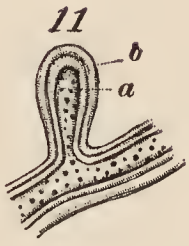
I have given Dr. Wright's history of *L. producta*, as it is the nearest to *L. cæruleus*, and answers for it with the following exceptions : *L. cæruleus* is of a delicate blue throughout—sheath and body ; *producta* sheath " pale yellow-brown ; body, blackish-

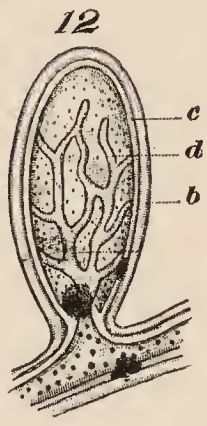


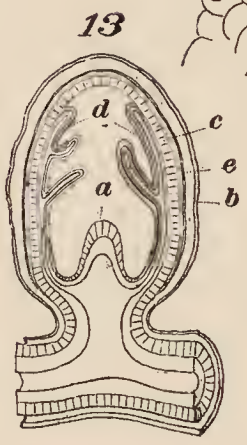


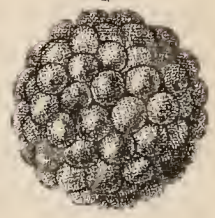


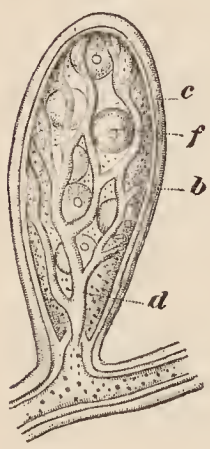


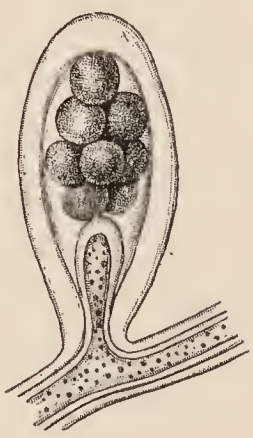


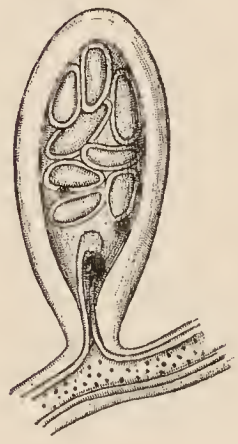


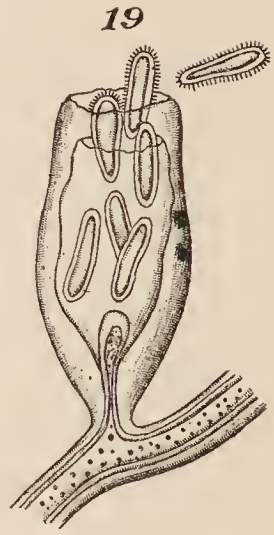


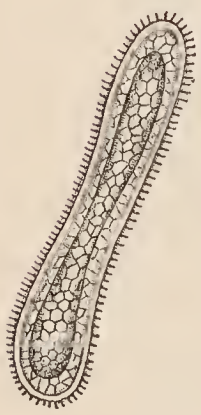


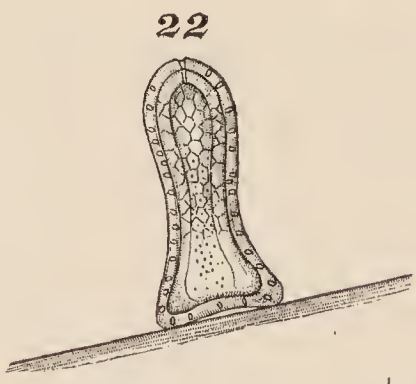


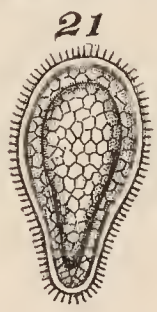


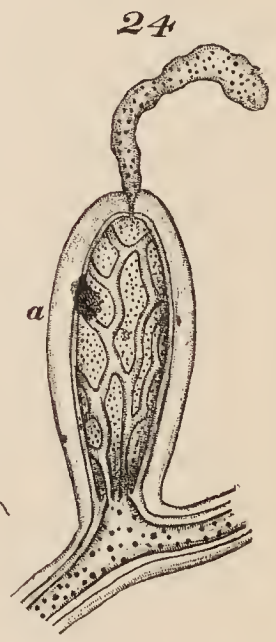












CORDYLOPHORA LACUSTRIS.

green." *L. cæruleus* is found in brackish waters, *L. producta* is a marine form.

L. cæruleus possesses, moreover, a strongly defined median line in each of its lobes, but no such line is shown in Pritchard.

No vent is mentioned by Wright in any of the species of the genus, viz.: *L. viridis*, *hyalina*, *atro-purpurea*, and *producta ;* there is one in *cæruleus*, by which excrement is voided, at the base of the lobes, but it can only be seen when in action.

Urnatella Walkerii sp. n. (Pl. 29, Fig. 3).

The polyzoön represented in Fig. 3 I have characterized as *Walkerii* after my friend who was with me when it was captured. It is a pretty and very polite form, very shy, and about the one-thirtieth of an inch in length when extended. Its politeness consists in very frequently bowing body and stem from its base, and then returning to an erect position.

It is almost identical with *U. gracilis* Leidy, save that *gracilis* has several constrictions in the stem, whilst *Walkerii* has the stem perfectly plain and somewhat tapering. Leidy says of *L. gracilis*: "The longest stems consist of a dozen joints, and measure about

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Explanation of Plate 31. (After Allman.)

Cordylophora lacustris. Fig. 4. Portion of the walls of the stomach highly magnified *a*. Ectoderm, its cells containing thread-cells. *b*. Endoderm composed of elongated cells, with true secreting cells in their interior. *c*. Secreting cells with evident nucleus. *d*. Secreting cells with nucleus obscured. *e*. Granular mass. *f*. Muscles.—Fig. 5. Thread-cells before exsertion of filament.—Fig. 6. Thread-cells after exsertion of filament.—Fig. 7. Cells liberated under pressure from the ectoderm, some with a thread-cell, others with a nucleus.—Fig. 8. Cells liberated by pressure from endoderm of stomach.—Fig. 9. Portion of tentacle near its root. *a*. Ectoderm with thread-cells. *b*. Endoderm. *c*. Muscular fibres.—Fig. 10. Cells containing secondary cells from endoderm.—In Figs. 11–14 the letters indicate : *a*. Diverticulum from the cœnosarc. *b*. External investment of the reproductive capsule. *c*. Cellular sac. *d*. Ramified canals. *e*. Structureless sac secreted outside of the cellular sac.—Fig. 11. Reproductive capsule, very early stage.—Fig. 12. The same, more advanced.—Fig. 13. Ideal longitudinal section of the same at the same stage.—Fig. 14. The capsule more advanced, the ova being visible.—Fig. 15. The same still further advanced, the ova lying on the extremity of the diverticulum.—Fig. 16. More magnified view of ovum, segmentation into a mulberry-like mass.—Fig. 17. Capsule still further advanced, ova elongated.—Fig. 18. The same, ova swarming in interior.—Fig. 19. The same, sac ruptured, ova escaping as free ciliated infusoria.—Fig. 20. Embryo just after escape.—Fig. 21. The same, assuming pyriform figure.—Fig. 22. The same after locomotive stage, fixed by one extremity. Fig. 23. Further development, tentacula budding, stem surrounded by a delicate polypary.—Fig. 24. Male capsule. *a*. Contents escaping under slight pressure. *b*. Caudate cells liberated from capsule. *c*. Spermatozoa.

the one-eighth of an inch in length ; the shortest stems have one-third the number of joints." From the construction of the stems he further argues : "As in the other fresh-water polyzoa, the polyps die on the approach of winter, but the headless stems appear to remain securely anchored and ready to reproduce the polyps in the spring."

From my short acquaintance with the new form, I am not at present able to confirm or reject Leidy's theory; but he was a very careful observer, and his recent death was a great loss to science.

In *U. Walkerii* the tentacula are from eight to ten in number, and unusually short and stumpy, with thirty or forty cilia on each side. There is an upward circulation—shown in the left of the figure—a crushing apparatus in the œsophagus, whilst the gizzard performs its functions with a quick revolving motion.

Octocella Libertas sp. n. (Pl. 29, Fig. 4).

This beautiful little polyzoön I have named *Octocella* from its possession of eight tentacles, and *libertas* in recognition of its being found in the shadow of the Statue of Liberty.

The process known as "introversion" is remarkable in this form, whilst it is also a fine example of ciliary action. It is, when extended, very clear, and is provided with a crushing apparatus in the œsophagus, by which the food is prepared for the action of the gizzard beneath. But the structure and mode of reproduction in the Polyzoa have been so frequently and so fully described by able writers that it would be presumptuous in me to enter the lists, unless our small friend should manifest some undescribed peculiarities.

Cordylophora Coronata sp. n. (Pl. 29, Fig. 5).

This member of the group Hydroida must at once take rank as one of the most attractive forms I have beheld in an experience of thirty-five years. As it seems hardy, it is a very valuable addition to our "exhibition objects." I have now in my aquaria some of my original gathering, made more than two months ago.

When first found, as I did not then happen to be one of the select few who have been favored with a sight of *C. lacustris*, it was taken for that form ; but on hunting it up in the *Philosophical Transactions*, 1853, I found that, whatever it was, it was not that,

the number and position of the tentacula alone precluding that possibility.

Like the typical Hydra, it rises on an elongated stem, and extends tentacles armed with bundles of thread-cells, also Hydra-fashion; but then all resemblance ceases. Its tentacles range from twelve to thirty in number, and spring from a continuous ring around the upper portion of what may be called the head, and just below the mouth. A short distance from the base they are connected by a beautifully delicate "web," thus forming a perfect funnel (see Fig. 5*a*, which is a view from above). This web-like joining of the tentacles doubtless aids in their more rapid contraction when alarmed, and would seem to foreshadow the similar connection shown in *Plumatella* and other polyzoöns. Notwithstanding their number, and the absence of highly developed muscular power as seen in the Rotifera and Polyzoa, they appear to be under absolute control.

The thread-cells are very numerous, ranging from eighty to one hundred bundles on each of the tentacula. I have reason to believe that reproduction is effected in a similar manner to that of *C. lacustris*. Indeed, I have already noted some points of resemblance, and when my observations are completed I hope to have the pleasure of laying them before the Society.

Cordylophora Lacustris Allman (Pls. 30, 31).

I have now to narrate a singular coincidence which occurred in connection with the discovery of the preceding forms.

Whilst looking over my stock of *C. coronata* I noticed one different to all the rest, and on fishing it out and giving it time to recover from its surprise, to my utter amazement I found I had before me a solitary specimen of *C. lacustris*. As I have before said, I had not previously seen it nor Dr. Allman's memoir, and should not have known it but for my recent searches and the drawings I had made.

Had a choice been given me, it would have been this form above all others, and more especially for the purpose of comparison; and, therefore, my pleasure on seeing it gradually unfold itself in all its beauty can be more easily imagined than described. Fearing I might lose it, I exhibited it, without remarks, at the Society's meeting on November 6th, 1891.[1]

[1] This specimen was exhibited by Mr. Horace W. Calef for Mr. Helm.—Ed.

As *C. lacustris*—according to Dr. Stokes—has only been found three times before in this country, twice by the late Prof. Leidy and once by Mr. Carter of Johns Hopkins University; as Dr. Allman's paper is the only standard authority upon it, and almost as rare as is the animal itself; and believing it will be fully appreciated by microscopists generally, and at the same time afford a convenient opportunity for comparison with the new form, the authorities of the Society have kindly consented to reproduce the plates of Dr. Allman's paper, as read before the Royal Society, and published in *Phil. Trans.* for 1853.

The only additional remark I have to make is on the difference between my illustration of the perfect animal, and Dr. Allman's. My drawing is an almost exact reproduction—making some allowance for perspective—of the position of its twelve tentacula during the fifteen days I had it under observation. As it lived so long, I was indulging the hope that it might bud and multiply; but when it did collapse, in a few hours there was no trace of its existence left behind. Never did I so sincerely mourn the loss of a specimen, and although I spent many, many hours in searching, I could not find another.

NOTE.—Since the reading of this paper I have met an article by the Rev. Thomas Hincks, B.A., published in the *Popular Science Review* for 1870, describing a polyzoön named *Valkeria pustulosa*, which in some respects very closely resembles *Octocella libertas;* but the woodcut is very indistinct, whilst there is no mention made of a tube. If Mr. Hincks be living, perhaps he may be able to throw some light on the subject.

PROCEEDINGS.

Meeting of December 4th, 1891.

The Vice-President, Mr. J. D. Hyatt, in the chair.

Seventeen persons present.

Messrs. Stephen Helm and Alfred Kroger were elected Resident Members.

Mr. Walter H. Mead, chairman of the Committee on Nomination of Officers, presented the report of the Committee, nominating officers for the coming year.

The Corresponding Secretary read a communication from Mr. G. R. Lumsden, of Greenville, Conn., donating to the Society a packet of diatomaceous material from a peat bog at Amherst, Nova Scotia.

On motion the thanks of the Society were tendered Mr. Lumsden for this donation.

Dr. N. L. Britton read a paper entitled "The North American Species of the genus Scirpus." This paper was illustrated by many herbarium specimens, and the fruit of two species under microscopes, as noticed in the programme.

Mr. Stephen Helm read a paper entitled "*Cordylophora lacustris* and five new forms of Animal Life." This paper was illustrated by original drawings and by objects under microscopes, and is published in this number of the Journal, p. 43.

OBJECTS EXHIBITED.

1. Head of the Spider, *Attus tripunctatus* Hentz, female, showing the eight eyes, palpi, falces, and fangs : by J. L. Zabriskie.

2. Section of an Ammonite from Würtemberg, Germany, being a cast composed of iron pyrites : by J. D. Hyatt.

3. Section of Agate, regular greenish aggregations covered with a dense pubescence : by J. D. Hyatt.

4. "Slug-form" of aquatic life, designated as "No. 1" : by James Walker for Stephen Helm.

5. *Cordylophora coronata* n. sp., from the Morris & Essex Canal : by Stephen Helm.

6. Achene of *Eleocharis mutata :* by N. L. Britton.
7. Achene of *Scirpus microcarpus* Presl.: by N. L. Britton.

Meeting of December 18th, 1891.

The Vice-President, Mr. J. D. Hyatt, in the chair.

Thirty-three persons present.

Mr. Charles F. Cox delivered a lecture entitled "What is a Diatom?" This lecture was illustrated by one hundred stereopticon projections of diatoms, and is published entire in the January number of this volume of the Journal.

On motion the thanks of the Society were tendered Mr. Cox for this interesting, valuable, and beautifully illustrated lecture.

On motion it was resolved that when the Society adjourns it adjourn to meet on the evening of January 5th, 1892.

Meeting of January 5th, 1892.

The President, Mr. P. H. Dudley, in the chair.

Twenty-eight persons present.

Prof. Henry M. Rusby, M.D., and Mr. J. W. Lloyd were elected Resident Members.

The Annual Reports of the Treasurer and the Committee on Publications were presented and adopted.

This being the designated time for the election of officers, the chair appointed Dr. Edw. G. Love and the Rev. Geo. E. F. Haas tellers, and at the close of the polls the following persons were declared elected as officers of the Society for the coming year:

President, J. D. Hyatt.
Vice-President, Charles S. Shultz.
Recording Secretary, George E. Ashby.
Corresponding Secretary, J. L. Zabriskie.
Treasurer, James Walker.
Librarian, Ludwig Riederer.
Curator, George E. Ashby.
Auditors, { F. W. Devoe. / W. E. Damon. / F. W. Leggett.

The Corresponding Secretary read a communication from Mr. K. M. Cunningham, dated Mobile, Alabama, December 4th, 1891, donating slides and material to the Society as follows :

"The slides and rock specimens are sent with the view of putting on record some new discoveries in microgeology of this character. Some years ago I donated a thin section of an indurated silicious sedimentary rock which I regarded as a tripoli, as the specimen seemed to show innumerable spicular spaces filled with air. I also sent smoothed specimens to exhibit the superficial aspect as opaque objects. I even then suspected that the rock contained polycistinous bodies. While in Meridian, Miss., during last October, I secured additional specimens of the rock, varying in density. A few days ago it occurred to me to test what I could find in the way of remains of Microzoa in the softer and chalkier specimens. I brushed down in water the surfaces of three different pieces, and was gratified by finding Polycistina and curious sponge spicules, gemmules, and plates of silex containing acicular inclusions. In pursuing this work I made the experimental slides sent to the Society, and on each slide I have noted with a small dot of india ink the situations of various specimens of Polycistina. About seventy-five organisms are shown.

"In the rock specimens sent there are three grades of hardness, and the two soft specimens were used by me in securing the specimens on the slides. The material occurs in great stratified beds with horizontal planes, which are shown very numerously in Clarke Co., Miss., north of Enterprise, in the deeper cuts of the Mobile & Ohio Railroad.

"Some years ago, in attempts to make magnifying glasses, I gave the optical polish to the lenses with this same tripoli stone scraped to a fine flour. I believe the slides will demonstrate something entirely new in the microscopical material line, as I have reason to believe that the composition of this rock had not been previously determined under micro-analysis by any one even in the State of Mississippi."

On motion the thanks of the Society were tendered Mr. Cunningham for these donations.

The President, Mr. P. H. Dudley, delivered his Annual Ad-

dress, entitled "Structure in Steel," illustrated by numerous specimens.

OBJECTS EXHIBITED.

1–35. Specimens of Steel, illustrating the Annual Address: by P. H. DUDLEY.

36. Polycistina from Enterprise, Miss., prepared and donated to the Society by Mr. K. M. Cunningham: by J. L. ZABRISKIE.

37. A new Microscopical Lamp, manufactured by James Stratton & Son: by J. L. ZABRISKIE.

38. Transverse section of stem of Wistaria, double stained: by FRANK D. SKEEL.

39. Transverse section of quill of Porcupine, double stained: by J. D. HYATT.

Mr. Zabriskie remarked concerning the microscopical lamp invented and manufactured by James Stratton & Son, 207 Spencer street, Brooklyn: It is remarkable for its compactness, its ease and variety of adjustments, its efficiency, and its very moderate cost. It stands upon a marbleized slate base three and one-half inches square. From one corner of this base rises a firm metal post three inches in height. A joint at the upper extremity of this post carries a two-jointed metallic arm, which in turn supports a bull's-eye lens nearly three inches in diameter, and the lamp-bowl surmounted by its glass chimney and japanned metallic shade. All the metal parts, excepting the base, burner, and japanned shade, are nickel-plated. The range of motion in the two-jointed arm, and the angle at which the lamp-bowl can be safely inclined when elevated, give a surprising variety of elevations and inclinations for the body of light passing through the bull's-eye. Discs of ground and blue glass are supplied for the conical opening of the metallic shade, which discs can be adjusted or removed with the greatest facility. The metallic shade fits loosely upon the burner of the lamp, and is also separate from the metal mounting of the bull's-eye. So that the varying effects of light, from the flat side or from the edge of the flame, can be obtained by merely revolving the lamp-bowl, while the shade, the bull's-eye, and all the appliances of the microscope itself remain in their last appointed positions. And further, if light is desired momentarily upon the table, it is only necessary to revolve

the metallic shade alone, and space near the hands, or of any other reasonably required position, can be instantly illuminated without disturbing any other adjustments. It is evidently a most desirable and satisfactory lamp.

Meeting of January 15th, 1892.

The President, Mr. J. D. Hyatt, in the chair.

Thirty-three persons present.

The following appointments were made by the chair:

Committee on Admissions: F. W. Devoe, William E. Damon, George F. Kunz, William Wales, F. D. Skeel.

Committee on Publications: J. L. Zabriskie, William G. De Witt, Walter H. Mead, John L. Wall, Charles F. Cox.

F. D. Skeel and Walter H. Mead were added to the Committee on Annual Reception.

Dr. A. A. Julien read a paper, entitled "A Fungus in Silicified Wood from Arizona and Texas." This paper was illustrated by twenty-three photomicrographs and by objects under microscopes, as noted below.

OBJECTS EXHIBITED.

1. Galvanoplastic reproduction of the Permian Reptile, *Seeleya pusilla*, from Bohemia.
2. Restoration in bronze of the complete Reptile.
3. Artificial Rubies, and thirteen prints illustrating Rubies.
4. Piece of a crucible used in the manufacture, with Rubies adhering.
5. Entomological preparations in solution, by Dr. Fischer, of Bohemia, showing the developing stages of a Cockchafer, from the egg to the imago.
6. Preparations in solution, by Dr. Fischer, of Termites in all stages.
7. Angle-measuring apparatus by Fuess, of Berlin.
8. "Dreh-Apparat," devised by Prof. C. Klein, of Berlin.
9. Small pocket lens made of Feldspar.
10. Specimens of thin Quartz, which when pressed with a pin-point always break into the rhombohedral cleavages.
11. Prism made of crystal of Iceland Spar.

12. True Ruby in matrix of limestone from Burmah.

13. Artificial Emeralds.

14. Rainbow Agate.

15. Zuñi Bread.

16. The new Nachet Grand Petrographical Microscope, with Dr. Koch's Microscope Lamp.

Exhibits 1–16 all by GEORGE F. KUNZ.

17. Macrospore of *Siderothrix* in Silicified Wood: by A. A. JULIEN.

18. Macrospore germinating in Silicified Wood: by A. A. JULIEN.

19. Crystals of Calcium Oxalate in Silicified Wood: by A. A. JULIEN.

20. The parasitic Wasp, *Hyptia* sp.: by J. L. ZABRISKIE.

Mr. Kunz furnished the following explanation of his exhibits:

"The researches on the production or synthesis of the ruby have been carried on in the laboratory of the Musée d'Histoire Naturelle of Paris from 1887 to 1890, and to some extent since then. In the first work published by them, M. Fremy and M. Verneil announced that they had obtained rubies approaching a lively red color, made in a crucible of refractory porcelain containing a mixture of aluminate of lead and bichromate of potash, the silica of the crucible uniting with the lead of the lead aluminate and forming a fusible silicate of lead, and the alumina crystallizing as rubies. The crystals formed in quantity and were of a good rose color, but were always lamellar and friable.

"In a second work published by them, it was announced that they had made transparent rubies that were brilliant, crystallizing as rhombohedrons, the crystals being of a purity equal to that of natural rubies. These were made in a refractory crucible, at a high temperature, containing a mixture of alumina with a little potash, fluoride, or barium, and bichromate of potash. It was found indispensable to pass a current of air through the crucible. The alumina combined with the potash and the air passing through the crucible, causing at a very high temperature the hydrofluoric acid to separate from the barium and form an alkaline fluoride, the rubies remaining in a state of absolute purity in a matrix of alumina.

"Every time the fluoride or alumina was elevated to a tempera-

ture of 1,500° C., the influence of the humid air always caused the formation of the rubies and the separation of the hydrofluoric acid. And at the close of their studies on the Synthesis of the Ruby they announce that rubies can be made in two different ways: by the decomposition of the alkaline aluminate by the influence of hydrofluoric acid, or by merely heating the fluoride of aluminum to a temperature equal to that of its disintegration.

"The illustrations which I exhibit this evening I have taken from 'The Synthesis of the Ruby,' by E. Fremy, 1891, 4to, page 58, plate 21, published by Vve. Ch. Dunod, Paris. Some of the largest rubies figured on these plates have been magnified sixty diameters, *hence their true diameter is from one to two millimetres*—one-twenty-fifth to one-twelfth of an inch. M. Fremy did not succeed in obtaining crystals weighing more than fifty-five milligrammes—one-fourth of a carat—each, before cutting, and the rubies, in the jewelry figured on these plates, were natural crystals, not cut gems. *Up to the present time he has not produced rubies of sufficient size to warrant their sale in the gem markets.*

"Prof. Dr. Anton Fritsch, Director of the Royal Geological Survey of Bohemia, has prepared, in all, two series, by the galvanoplastic process, of reproductions of the Permian reptiles of Bohemia. Many of these are exceedingly small, and the markings of their remains in the rocks are very delicate. The smallest and most interesting of the group is the *Seeleya pusilla*, which I show this evening under a three-inch objective. The entire reptile measures less than one inch in length. Dr. Fritsch has also restored twelve of the more important reptiles, and has arranged them on a fac-simile of Permian rock. Under a three-inch objective the complete reptile is shown, the dentition being remarkably perfect, as well as all the vertebræ and the feet. A photograph of this I have brought with me this evening, and also one of the isolated reptiles—*Ricnadon*—of this group.

"The optician, Ivan Werlein, of Paris, while making some plates of quartz for a new galvanometer, found it necessary to cut these sections parallel to the rhombohedron, making the sections the thinness of less than one-tenth of a millimetre, or one-two-hundredth of an inch, of three inches in length and one-half an inch in width. These plates of quartz were coated on the one side by a thin deposit of silver, the current being measured

by the deflections of the plate. Of great interest is the fact that these thin plates of quartz, when punctured by a pin or needle-point, separate with rhombohedral cleavages, showing that quartz, the cleavage of which is otherwise never very facile, when prepared in these sections is one of the most highly cleavable of all minerals.

"To increase the sensibility of the tourmaline forceps, Werlein has attached to one of the tourmalines a small condenser of didymium glass, producing excellent results.

"Dreh-Apparat—turning apparatus—devised by Prof. C. Klein, of Berlin, and made by Fuess, of Berlin. Described in *Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin*, Sitzung der physikalische-mathematischen Classe vom 30. April. 'Krystallographisch-optische Untersuchungen. Ueber Construction und Verwendung von Drehapparaten zur optischen Untersuchung von Krystallen in Medien ähnlicher Brechbarkeit,' von Carl Klein, pages 1 to 10. Used to examine entire crystals, fragments, and minerals cut into gem form, under the polariscope and microscope.

"Axis-measuring apparatus on the Adam principle, made by Fuess, of Berlin, Germany, for examining the optical properties of minute scales of fragments of minerals. Described in *Ueber Mikroskope für Krystallographische und Petrographische Untersuchungen*, von R. Fuess, Berlin, S. W., 108 Alte Jacob Strasse, pages 25 to 28, 1891.

"In connection with these two pieces of apparatus, I would remark that Pulfrich gives a list of twenty-six liquids of varying refractive indices, 1.5381 dispersion equalling 0.0142 to iodide of mercury dissolved in aniline and chinoline refractive indices 2.2, and when dissolved with lepodine a still higher index.

"Pocket lens, one-fourth inch, made of oligoclase feldspar from Bakersville, North Carolina, described by George F. Kunz in *Amer. Jour. of Sci.*, series iii., vol. xxxvi., page 222.

"Artificial Ruby, made by E. Fremy. Two series of slides of detached crystals, and one piece of crucible with rubies adhering. Described by E. Fremy in 'Synthesis of the Ruby,' Paris, 1891, page 58, plate 21, published by Vve. Ch. Dunod.

"After listening to Dr. Julien's paper, I would state that I visited the localities last summer, and conform with the observa-

tions made by Dr. Julien, that the formation in which the wood is found is of considerable extent, and has been traced in New Mexico and Arizona for some hundreds of miles, and had been referred to the Chinarump Group of the Jura Trias by Major J. W. Powell. My observations of the locality lead me to the conclusion that silicious water was the silicifying agent. The trees, having fallen into water, had partly rotted, and only after sinking in the swamp, lake, or river had silicification set in. The trees on the lower levels in the so-called parks did not really belong there, nor had they come from any of the layers of rock from the same level, but from the top strata, in some places one hundred feet above where they lie at present. I observed trees *in situ* only in this upper layer. One tree *in situ* measured over one hundred feet in length. From the total absence of roots and branches and bark, I conclude that the wood had not been silicified in the same manner as the agatized woods of Yellowstone Park and Colorado, where the logs or trees are generally hollow, inasmuch as all the Arizona trees must have silicified in a recumbent position, having fallen in some unknown lake, sea, river, or swamp. And, further, that as there was no bark on any of the trees, they must have rotted, and in some of the masses examined at least four or five inches of the bark and outer rings of the tree were missing. They were silicified in water highly charged with oxide of iron, the red or yellow color varying according to the amount of oxide present, probably by decomposition of a variable amount of vegetable matter. The presence of the fungus *zoöglia*, described by Dr. Julien, has probably induced the precipitation of silica from the water in which the tree trunks lay."

Mr. Zabriskie said of his exhibit : "This small parasite, collected at Fisher's Island, L. I., is one of the most curiously formed parasitic wasps of our fauna. The slender petiole of the abdomen, instead of being placed in the usual position, is inserted high up on the back, at the base of the metathorax. The abdomen is greatly compressed, and the area of its side is only one-fourth of the corresponding area of the thorax, causing the abdomen to appear ridiculously small. The anterior wings possess only one cell—the costal cell—and are furnished with costal, subcostal, and basal nervures, and with a prominent

stigma. The abdomen is so highly polished that, when looking in the microscope, the observer can see, reflected from the side of the abdomen, a perfect inverted image of the body of the microscope, the observer's head, and any object near it, especially the hand, when moved near the face.

"In a case is also exhibited another species of *Hyptia*, collected at Flatbush, L. I., differing in coloration, but quite similar in size and form to the first specimen. Also in the same case a specimen of *Evania appendigaster* L., collected in the City Hall Park, New York City. It will be seen that this *Evania* resembles very closely the two specimens of *Hyptia* in general form and in the insertion of the petiole of the abdomen, but it is of twice their size, differs in the neuration of the wings, and has the posterior legs relatively much longer.

"Only one species of *Evania* is recorded for the United States, and it is parasitic on the cockroach. Three species of *Hyptia* are recorded for the United States, but their habits are not reported."

Meeting of February 5th, 1892.

The President, Mr. J. D. Hyatt, in the chair.

Twenty-one persons present.

The Corresponding Secretary read the following communications from Mr. K. M. Cunningham, of Mobile, Ala., accompanying donations to the Society :

"January 15th, 1892.

"EXPLANATORY NOTES ON SLIDES DONATED TO NEW YORK MICROSCOPICAL SOCIETY.

"Two slides of fresh-water diatoms, derived from subsoil at Tuscaloosa, Ala., within a park enclosure facing grounds of Alabama Asylum for the Insane; material excavated from a drainage ditch through the oak grove. The associated species are few, viz.: *Navicula viridis*, *Stauroneis phœnicenteron*, *Nitzschia amphioxys*, *Eunotia diodon*, and sponge spicules; the locality is the site of a former muck basin; the deposit may be said to be common to all low drainage areas about Tuscaloosa

traversed by spring branches, the formed earth carrying a large proportion of vegetable débris.

"Five slides illustrating vegetable or plant structure in Alabama coal; all of the specimens being derived from a non-coking, semi-bituminous coal from the Deer Creek coal vein, Walker Co., Ala. This variety of coal burns quietly, without bituminous intumescence, thus leaving foliated plates of a whitish shale, which can be readily separated into thin pellicles, and from these pellicles there can be isolated two specific kinds of vegetable structures, derived from stems, branches, or trunks of coal-forming plants; and a third kind of vegetable structure, shown in tlide labelled 'Fossil Sporangia.' When isolated from the burned coal shale in their unbroken state, they are very minute, oval, scale-like porcelain plates, having a collapsed appearance, and when first enclosed in balsam show numerous dark annular spaces which become semi-transparent rings when the air is expelled from the sporangium. These minute bodies may be construed as a key to one of the associated phenomena of the formation of coal strata in geologic time, in this wise: they aid in proving that coal is a sedimentary aggregation of microscopic plant particles, in connection with larger or grosser vegetable particles, readily visible to the eye, such as the seal-like impressions of Sigillaria stems, the fossil 'charcoal' commonly seen on the deposition layers of the bituminous coals of Alabama, and in the pyritized shales occurring interbedded in the coal, which show clearly vegetable structure in profusion, but of little structural interest under the microscope. An analogy between the formation of coal strata, recent marine muds, and fossil diatomaceous strata has, by the discovery of the fossil sporangia in coal, been suggested to me, in this sense: that in all preliminary cleanings of Mobile Bay marine muds, of the marsh muds, and of the several fresh-water fossil diatomaceous earths recently examined by me, there is a moderate proportion of vegetable débris of plant tissues, but more particularly and invariably an abundance of coniferous or pine-pollen grains, which are of such a special bilobated structure as not to be readily confounded with any other organic structures, vegetable or mineral; and as these pine-pollen grains are abundant in the Montgomery, Ala., diatomaceous earth, which is also exceedingly rich in fresh-water diatoms,

and its period of deposition antecedent to that of the overlying gravel beds and alluvial sands, the association of the pollen grains with the diatoms proves them to be of contemporaneous growth and deposition; and the survival of the pollen from decay may be attributable to their resinous nature, which is likewise a characteristic of the spores of the present fern-vegetation of the earth, as well as that of the carboniferous period in geology.

"One slide of macrospores. These interesting fossil plant remains were isolated from a shale from Ontario, Canada, by crushing the shale transversely to its layers. Under a high power they show spinous processes regularly distributed over their surfaces. When a single specimen is ignited on mica, it melts to a shapeless bituminous mass and is reduced to ash. The slide is sent for comparison with the fossil sporangia from Alabama coal.

"Four slides derived from a study of material from borings of a now celebrated artesian well at Mobile, Ala., 850 feet in depth, recently finished. One shows a group of forty foraminifera of a single species, being very nearly the only microscopic animal remains permeating 500 feet of greensand strata. Two of the slides show a sand of high specific gravity, composed of myriads of spherules, octahedral and dodecahedral crystals of pyrite, also perfect microscopic quartz crystals, polished agate and sand grains, and grains of magnetite, all associated together. One slide of magnetite grains, including iron scales from boring tubes. These grains were separated from the pyrites sand with a small magnet, and as mounted will serve to illustrate a number of interesting experiments under the microscope. For example, when the grains are evenly scattered on the slide the effect of the union of the grains may be noted when a small horseshoe magnet is applied to the under side of the slide. If one leg or pole is presented, the grains stand in vertical chains; and if the magnet is moved in rapid circles, double or multiple images of the grain chains succeed each other in waltzing style; if the slide is held in a vertical plane, and both poles applied to the cover glass, a single chain of grains is lifted to top of cell and drops at once on removal of the magnet. The grains may be scattered by tapping with the thumb nail, and each grain may be examined for mineralogical character. When this pyrites sand is heated

red-hot, the crystals and spherules of pyrite are turned to a red oxide soluble in water. Grains not soluble are attracted by the magnet, while as unburned crystals of pyrite the magnet has no influence on them.

"Four slides to illustrate and place on record for the first time the occurrence of a new deposit of tripoli, being a marine fossil sedimentary rock recently discovered by me, its true character having been misunderstood until I demonstrated it by microscopic analysis. Its geographical position is indicated as follows: It occurs at the Big McGrew's Shoal on the Tombigbee River, Clarke Co., Ala., one mile by land northeasterly from St. Stephens, or three miles by river. This shoal is now being blasted out and improved under Government supervision, and specimens of the different rocks forming the obstruction were forwarded to U. S. Engineer's office at Mobile, where I casually found it. At this time it seems to have an unique interest, as I know of no other rock or tripoli similar to it in mineral or fossil composition. Its uniqueness lies in the fact that it is a tripoli that breaks down easily to a mud in water, and is very rich in marine fossil Diatoms, Polycistina, Foraminifera, sponge spicules and gemmules, plant débris, and mineral grains, notably crystalline chloritic grains; and that the Diatoms, Polycistina, and Foraminifera are infiltrated by transparent mineral, decussating, crystalline plates, not readily soluble in acids, thus nearly obliterating the sculptural markings on their surfaces, and thus practically being *petrified* Diatoms, Polycistina, and Foraminifera. The slides sent were made by rubbing the dry tripoli powder, after cold acid treatment, on chamois skin, to remove the undesirable amorphous particles of silica. The Diatoms, Polycistina, and Foraminifera survived this polishing ordeal, thus attesting their toughness through petrifaction. Species of the following genera may be seen on the slides, viz.: *Coscinodiscus*, from very large to small species; *Triceratium*, triangular and square forms; and a *Biddulphia* and *Cyclotella*. The Polycistina and Foraminifera do not require special mention. The reticulation on the *Coscinodisci* can be made out with a one-sixth objective and good daylight. Another matter of interest that this new find revives is the fact that Dr. C. G. Ehrenberg, in his 'Micro-Geologie,' listed many of the living fresh-water

diatoms from the Tombigbee River and Sintabogue Creek in this immediate neighborhood, but must have failed to get samples of this marine tripoli, as it would have been a 'capital prize' on account of its richness in organic fossil remains.

"One slide showing a thin section made from an opalized or indurated form of the same tripoli stone referred to above.

"I followed the borings of the artesian well in the hope of corroborating the occurrence of marine diatomaceous clays, such as occur on the Atlantic seaboard artesian-well area, but found the various strata, penetrated to a depth of 850 feet, absolutely void of diatomaceous forms. The last stratum of clay penetrated, before reaching the water sands, contained plant débris and fossil pollen grains alone. Bits of amber and pieces of pyritized coniferous wood and lignite were freely washed up, and generally secured by the curious spectators at the completion of the well.

"I forward also several specimen packets of the crude material from which most of the slides commented upon herein were made."

"JANUARY 20TH, 1892.

"I mail with this a package of raw material:

"1. A piece of coal shale—burned—from Deer Creek, Walker Co., Alabama coal. With an inch hand magnifier an abundance of the fossil sporangial bodies may be seen *in situ*. It is from this coal that I prepared the slide showing the spores in the fossil sporangial capsules, on the slide labelled 'Fossil Sporangia.'

"2. A specimen from the recently discovered locality in Clarke Co., Ala., near St. Stephens, of which I sent the Society four prepared slides of a new tripoli of the marine sedimentary class of rocks. The stratum belongs to the cretaceous rocks of Alabama.

"3. A packet of the pyritous sand and micro-minerals, of which I sent two slides previously."

"FEBRUARY 1ST, 1892.

"I send the following specimens:

"1. From McGrew's Shoal, Tombigbee River, near St. Stephens, Ala. The rock will interest the diatomist and petrologist, as it is a composite rock of marine sedimentary origin. It

will make a fine polariscope object, as a thin section will probably show Diatoms, Polycistina, Foraminifera, and sections of larger shells, the whole silicified and strongly crystalline in structure. It is from the same formation as the marine tripoli previously sent to the Society.

"2. A cement stone from Sendai, Japan. This was sent me by M. J. Tempère, Paris, joint editor of the 'Diatoms of Yeddo and Japan,' as a return for Montgomery earth. It can be used as thin sections, from which much may be learned of the internal structure of the Diatoms and Polycistina contained therein. Being of a flinty nature, it will take a vitreous polish, bringing out the internal structure as seldom seen in diatom slides.

"3. A piece of coniferous wood, derived from a vein of lignite, ejected from the depth of about 700 feet from the new artesian well recently finished at Mobile.

"4. A piece of genuine lignite coal, also from the artesian well, at a depth of 700 feet. When brushed down in water it furnishes fine slides, showing plant structures: as scalariform tissues, pitted ducts, reticulated tissue, and spores and capsules of several kinds. It is best studied with a high power. The whole is interesting when viewed in its mineralogical relation to bituminous coal and the immense period separating them geologically."

OBJECTS EXHIBITED.

1. Serial sections through the body, next and posterior to the gill covers, of the fish *Atherina* sp., Dotted Silverside: by L. Riederer.

2. Serial sections of the vertebral column of the same: by L. Riederer.

3. Serial sections of the same, showing gill arches: by L. Riederer.

4. Section of fossil Coral: by T. B. Briggs.

5. Crystals on under surface of glass covering a daguerreotype taken in 1850: by T. B. Briggs.

6. Larva of the wood-boring wasp, *Crabro sexmaculatus* Say: by J. L. Zabriskie.

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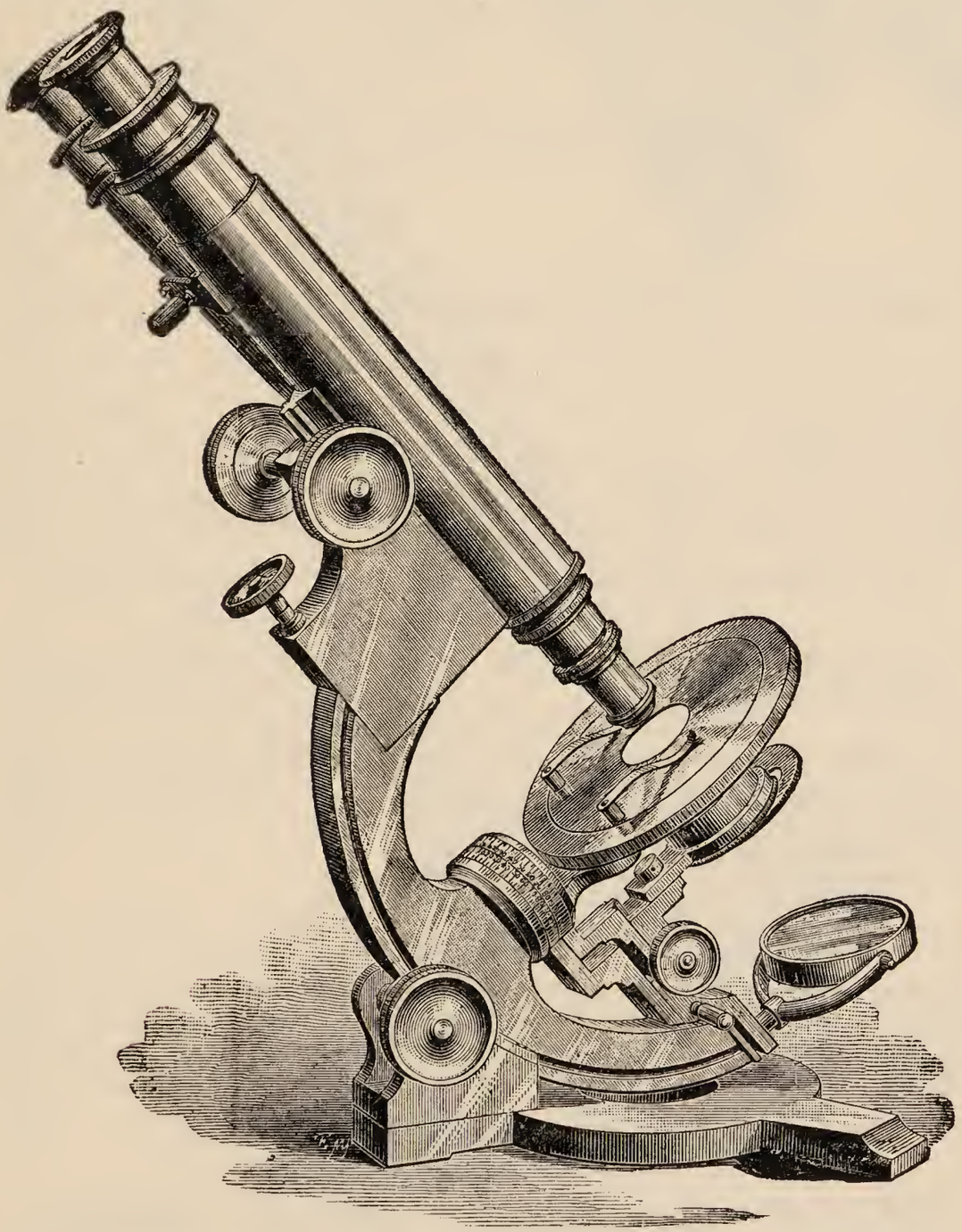

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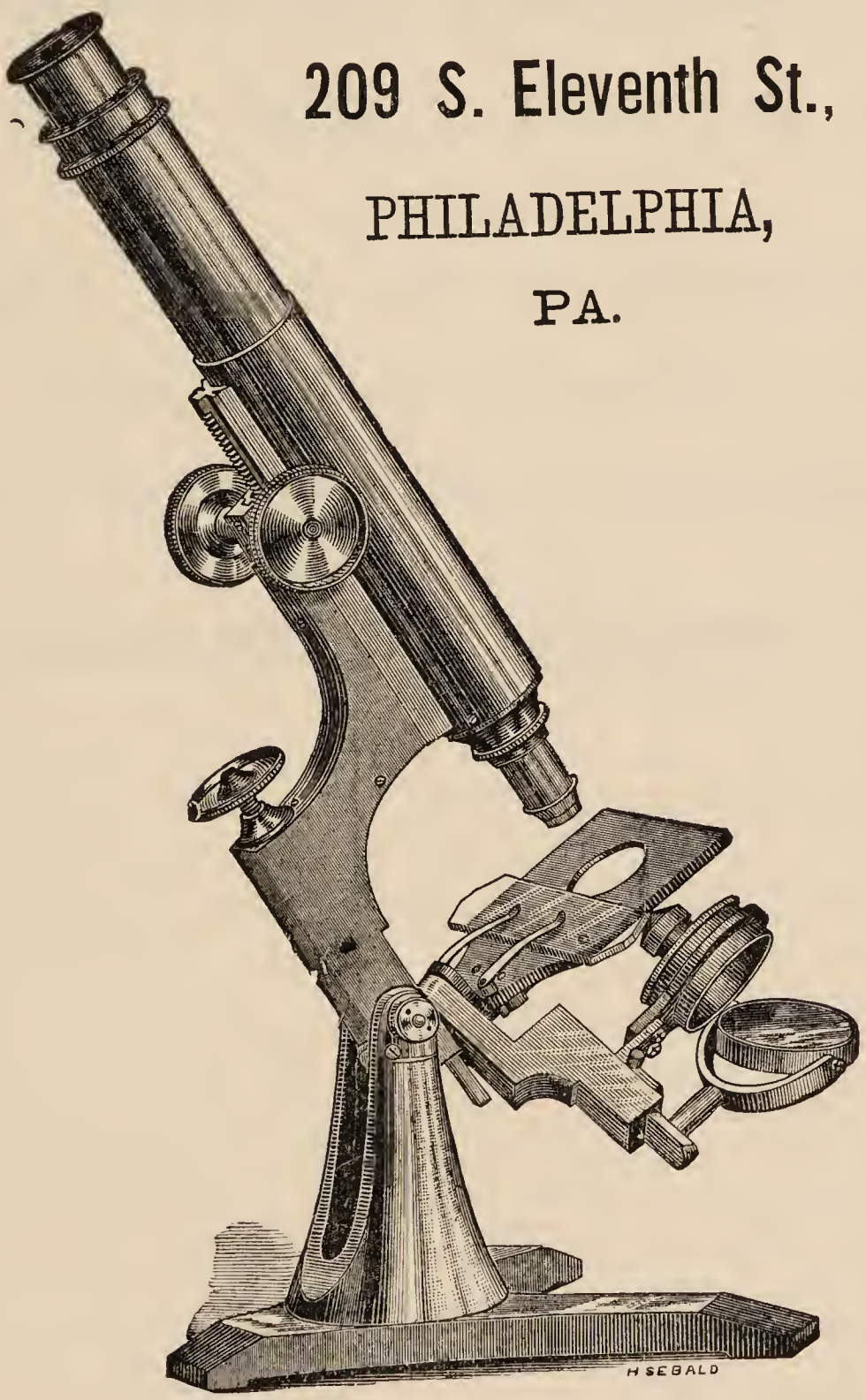

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